IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: **Davis, et al.**	§	Case: **6716/ETCH/SILICON**
Serial No.: **10/674,568**	§	Filed: **September 29, 2003**
Examiner: **Ram N. Kackar**	§	Group Art Unit No. **1763**
Confirmation No.: **3852**	§	
Title: **METHOD AND SYSTEM FOR MONITORING AN ETCH PROCESS**	§	

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

APPEAL BRIEF

The Appellants submit this Appeal Brief to the Board of Patent Appeals and Interferences to appeal the decision of the Examiner of Group Art Unit 1792 dated June 25, 2008, finally rejecting claims 1, 3-4, 6-13, 15-18, 20-21, 23-30, 32-33 and 50-59. The final rejection of claims 1, 3-4, 6-13, 15-18, 20-21, 23-30, 32-33 and 50-59 is appealed. The fee for a one-month extension of time and the fee for filing this Appeal Brief have been paid with the submission of this paper using the Patent Electronic Business Center. The Commissioner is authorized to charge any additional fees due for this Appeal Brief to Deposit Account No. 20-0782.

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Real Party in Interest

The real party in interest is Applied Materials, Inc., located at 3050 Bowers Avenue, Santa Clara, California 95054.

Related Appeals and Interferences

The Appellants assert that no other appeals or interferences are known to the Appellants, the Appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1, 3-4, 6-13, 15-18, 20-21, 23-30, 32-33 and 50-59 are pending in the application. Claims 1-49 were originally presented in the application. Claims 5, 22, and 34 were cancelled in the preliminary amendment filed January 7, 2004. Claims 2 and 19 were cancelled and claims 35-49 were withdrawn in the response filed December 27, 2005. Claims 35-49 were cancelled in the response filed May 22, 2006. Claims 50-60 were added in the response filed October 19, 1006. Claims 14, 31, and 60 were cancelled in the response filed March 30, 2007. The final rejections of claims 1, 3-4, 6-13, 15-18, 20-21, 23-30, 32-33 and 50-59 are now appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

All claim amendments have been entered by the Examiner. No amendments to the claims were proposed after the final rejection.

Summary of Claimed Subject Matter

Claimed embodiments of the invention provide a method and an apparatus for monitoring an etch process. (Abstract). In the embodiment of independent claim 1, a method for monitoring an etch process includes (a) performing pre-etch critical dimension (CD) measurements (206) of a substrate (75, 200) to generate pre-etch measurement information, (b) applying an outlier filter (13, 105) to remove outliers in the pre-etch measurement information, (c) analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate (75, 200) and to determine process parameters to an etch process; (d) providing the substrate (75, 200) along with the pre-etch measurement information to an etch reactor (1000), (e) etching the substrate (75, 200) in the etch reactor (1000) to form structures (250) in the substrate (75, 200) using the etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor an etch process endpoint, wherein the etch process monitoring comprises directing radiation onto the substrate (75, 200), wherein an intensity of the radiation is modulated at a frequency of about 10 Hz, and collecting a portion of the radiation (R1-R9) reflected from the substrate (75, 200) to determine critical dimension (216) of the structures (250) formed in the substrate (75, 200), and terminating the etch process based on the etch process monitoring having identified that the etch process has reached the etch process endpoint.

In the embodiment of independent claim 18, a method for monitoring an endpoint of a mask trimming process includes (a) performing pre-etch critical dimension (206) measurements of a substrate (75, 200) having a mask (210) thereon to generate pre-etch critical dimension measurement information of such mask (210), (b) applying an outlier filter (13, 105) to remove outliers in the pre-etch critical dimension measurement information, (c) analyzing the pre-etch critical dimension measurement information (206) to determine that the mask (210) is of a sufficient quality to allow for etching of the substrate (75, 200) and to determine process parameters to an etch process, (d) providing the substrate (75, 200) along with the pre-etch critical dimension measurement information (206) to an etch reactor (1000), (e) trimming the mask (210) using the etch process, wherein the pre-etch critical dimension measurement

information (206) in combination with etch process monitoring are used to in-situ monitor the trimming the mask (210), wherein the etch process monitoring comprises directing radiation (R1-R9) onto the substrate (75, 200), wherein an intensity of the radiation (R1-R9) is modulated at a frequency of about 10 Hz, and collecting a portion of the radiation (R1-R9) reflected from the substrate (75, 200), and terminating the trim process when the etch process monitoring indicates that the mask (210) has been trimmed to pre-determined dimensions (216).

In the embodiment of independent claim 50, a method for monitoring an endpoint of a mask trimming process includes performing pre-etch measurements (206) of a substrate (75, 200) having a patterned mask (210) thereon to generate pre-etch measurement information (206) of such mask (210), wherein the pre-etch measurements (206) include width of structures comprising the patterned mask (210) , applying an outlier filter (13, 105) to remove width outliers in the pre-etch measurement information (206), providing the substrate (75, 200) along with the filtered pre-etch measurement information (206) to an etch reactor (1000), (d) determining process parameters of an etch process in response to the pre-etch measurement information (206), (e) trimming the mask (210) using the etch process, wherein the filtered pre-etch measurement information (206) in combination with etch process monitoring are used to in-situ monitor trim process, wherein the etch process monitoring comprises directing radiation (R1-R9) having an intensity modulated at a frequency of about 10 Hz onto the substrate (75, 200), collecting a portion of the radiation (R1-R9) reflected from the substrate (75, 200), measuring an intensity of wavelengths in a spectrum of the radiation (R1-R9) reflected from the substrate (75, 200), and using a correlation between a spectral position of a minimum in the spectrum and a width of the structures (250) formed on the substrate (75, 200), and (f) terminating the trim process when the etch process monitoring indicates that the mask (210) has been trimmed to pre-determined dimensions (216).

Grounds of Rejection to be Reviewed on Appeal

Claims 1, 3-4, 6-7, 17-18, 20 and 23-24 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Toprac* (U.S. Patent No. 6,379,980) in view of *Payne* (U.S. Patent No. 5,329,381) or *Tanaka* (U.S. Patent No. 6,616,759), *Knoot* (U.S. Patent No. 6,130,415) and further in view of *Yonezawa et al* (U.S. Publ. No. 2003/0222231) or *Shoham et al* (U.S. Publ. No. 2004/0028267) or *Egermeier et al* (U.S. Publ. No. 2002/0006677) as evidenced by *Wilby* (U.S. Publ. No. 2003/0141572). Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Klippert II* (U.S. Patent No. 6,136,712) in view of *Payne* or *Tanaka, Knoot* and further in view of *Yonezawa* or *Shoham* or *Egermeier.* Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Morioka* (U.S. Patent Publication No. 2004/0060659) in view of *Payne* or *Tanaka, Knoot,* and further in view of *Yonezawa* or *Shoham* or *Egermeier.* Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Petrucci* (WO 01/24254) in view of *Payne* or *Tanaka*, *Knoot,* and further in view of *Yonezawa* or *Shoham* or *Egermeier.* Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* (U.S. Patent No. 6,390,019) in view of *Payne* or *Tanaka*, *Knoot,* and further in view of *Yonezawa* or *Shoham* or *Egermeier.* Claims 10, 20 and 27 stand rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* in view of *Payne* or *Tanaka*, *Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24, and further in view of *Bin Yu* (U.S. Patent No. 6,390,019). Claims 10, 20 and 27 stand rejected under 35 U.S.C. §103 as being unpatentable over *Morioka* in view of *Payne* or *Tanaka*, *Knoot,* and further in view of *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24, and further in view of *Bin Yu.* Claims 16 and 33 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* in view of *Payne* or *Tanaka*, *Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-9, 11-13, 15, 17-20, 23-26, 28-30 and 32, and further in view of *Grimbergen '924* (U.S. Patent No. 6,406,924). Claim 21 stands rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* in view of *Payne* or *Tanaka*, *Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as

applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and further in view of *Cha* (U.S. Patent No. 6,319,767). Claims 50-59 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* in view of *Payne* or *Tanaka*, *Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu*. Claims 50-59 stand rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* or *Klippert II* or *Petrucci* or *Morioka* in view of *Payne* or *Tanaka*, *Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu*.

ARGUMENTS

A. 35 U.S.C. §103 Claims 1, 3-4, 6-7, 17-18, 20 and 23-24

Claims 1, 3-4, 6-7, 17-18, 20 and 23-24 stand rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* in view of *Payne* or *Tanaka*, *Knoot* and *Yonezawa et al* or *Shoham et al* or *Egermeier et al* as evidenced by *Wilby*. The Appellants respectfully disagree.

Independent claims 1 and 18 recite elements not taught or suggested by the combination of *Toprac, Payne* or *Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier,* as evidenced by *Wilby*. *Toprac* teaches measuring a thickness of a process layer disposed on a substrate before an etching process. A removal rate may be determined based on the measured thickness of the process layer and an endpoint time. The Examiner asserts that *Toprac* discloses using pre-etch measurement for the purpose of determining parameters for adjusting or controlling an etch recipe, and it is obvious that during a pre-etch measurement of a pattern of poor quality its measurement will indicate that it is of poor quality. Examiner asserts that it would be commonsense not to allow further processing if next stage would not yield acceptable quality. The Appellants respectfully disagree.

A thickness pre-measurement of a to-be-etched film, as taught by *Toprac,* is used to calculate an etch rate of a targeted film. Once the pre-measurement data is obtained and an etch rate is calculated, an etching endpoint may be monitored or the process may be adjusted closer to the removal rate. However, *Toprac* does not teach analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. Accordingly, the pre-measurements of *Toprac* only provide information of thickness which may be used for rate calculation or in-situ process adjustment. Therefore, *Toprac* does not teach or suggest using pre-etch measurements for setting etch parameters prior to etching. Moreover, the pre-measurement as taught by *Toprac*

is not utilized in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate.

Payne teaches using an automatic engraving system to scan an image of a photograph to provide a rasterized gray scale data base of the image. The Examiner asserts that art may be outside Appellant's field of endeavor and still be analogous if both fields share the same common problem. The Examiner further asserts that measuring the pattern is similar to scanning an image as in *Payne*. The Appellants respectfully disagree.

Payne teaches scanning an image, such as a photograph, and using an appropriate algorithm, such as a photo processing software, programmed in a computer to process and reshape the scanned image. The algorithm programmed computer promotes resolution of the scanned image for use in an engraving system. After a sequence of mathematical calculations, the scanned image is corrected, resized, resampled, and digitally processed to produce a photograph with desired brightness, contrast, and constant pixel unit across the substrate. Accordingly, the algorithm programmed computer, as taught by *Payne*, is used to process and reshape a two-dimensional planar object. More specifically, the algorithm programmed computer, as taught by *Payne*, is used to digitally process and reshape a photograph. The *Payne* process is not used to pre-measure thickness or critical dimensions of a structure – but for reshaping for engraving. Moreover, the *Payne* process is not used to determine process parameters of an etch process. The photo reshaping process, as taught by *Payne*, is a digital and mathematical process and cannot be used to modify a process for monitoring an etch process to determine critical dimension of structures formed in a substrate.

Furthermore and contrary to the Examiner's assertion, the photo reshaping process, as taught by *Payne*, is not used to solve the same problem as the problem described in *Toprac*. *Payne* is utilized to improve digital resolution of a scanned image of a two dimensional object, while *Toprac* teaches pre-measuring a thickness of a film to calculate an etching rate for endpoint determination. The use of the photo digital reshaping improves image resolution, which is an issue not encountered by *Toprac.*

Tanaka teaches measuring processed substrate to develop an equation to predict process behavior. Some abnormal data as outlier may be removed to provide an accurate prediction for the process result equation development. *Tanaka* teaches collecting post process result to develop an equation for process behavior prediction. However, *Tanaka* does not teach or suggest pre-measure thickness or critical dimensions of a structure, as recited by claim 1 and 18. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. The measured process result data of *Tanaka* is used to develop an equation, not to determine process parameters to an etch process, or not even to in-situ monitor an etch process endpoint.

Knoot teaches a low temperature control of a rapid thermal process. In particular, the Examiner asserts that *Knoot* discloses "a modulation frequency of 10 Hz." The Appellants respectfully submit that frequency of less than 20 Hertz as taught by *Knoot* is used for a temperature measurement system in a rapid thermal process chamber. Accordingly, there is no reasonable expectation of success for utilizing a temperature sampling frequency of less than 20 Hertz of *Knoot* to modify the two-dimensional image correction process performed in an algorithm programmed computer of *Payne*, the measured process data of *Tanaka* and the thickness pre-measurement method of *Toprac* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, or applying an outlier filter to remove outliers in a pre-etch measurement information, analyzing the pre-etch measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch measurement information in combination

with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18.

Yonezawa teaches an apparatus suitable for taking post-etching measurements. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. *Wilby* is cited as evidencing use of ellipsometry or reflectometry. Thus, *Yonezawa, Shoham, Egermeier*, and *Wilby,* does not provide a teaching or suggestion to the combination of *Knoot*, *Payne*, *Tanaka* and *Toprac* as discussed above that would yield using an outlier filter to filter a pre-measurement critical dimension data, utilizing the pre-measurement critical dimension data when in-situ monitoring an etch process, or using the pre-etch critical dimension measurement in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate.

Furthermore, there is no teaching or suggestion from *Yonezawa, Shoham, Egermeier*, or *Wilby*, that would suggest one of ordinary skill in the art to modify *Toprac, Payne, Tanaka* or *Knoot* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch measurement information, analyzing the pre-etch measurement information to determine process parameters to an etch process and using the pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, and applying an outlier filter to remove outliers in a pre-etch measurement information, analyzing the pre-etch measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claims 1 and 18, and all claims depending therefrom, are patentable over the combination of *Toprac, Payne, Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier,* as evidenced by *Wilby*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

Additionally, claims 3-4, 6-7, 17, 20 and 23-24 are patentable over combination of *Toprac, Payne, Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier,* as evidenced by *Wilby,* at least by their dependency from claims 1 and 18.

Accordingly, the Appellants request the reversal of the rejection to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and the allowance of the same.

B. 35 U.S.C. §103 Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32

Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Klippert II*, in view of *Payne*, *Tanaka, Knoot* and *Yonezawa* or *Shoham* or *Egermeier*. The Appellants respectfully disagree.

Independent claims 1 and 18 recite elements not taught or suggested by the combination of *Klippert II, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier. Klippert II* teaches measuring or estimating an etching rate of an etch process to better control the depth formed or etched in a layer disposed on a substrate during an etching process. However, *Klippert II* does not teach or suggest using an outlier filter to filter a pre-etch critical dimension measurement data, utilizing the pre-etch critical dimension measurements to in-situ monitor an etch process, or using the pre-etch critical dimension measurement in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate.

As discussed above, the teachings of *Payne* and *Knoot* are not in the field of Appellants endeavor and not utilized to solve the same problem as discussed in the present application, nor does the record support utilization of the teachings of *Payne* and *Knoot* to obtain predictable results in the claimed subject matter. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for post-etching measurement. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. Thus, there is no suggestion from the teachings of *Payne, Tanaka, Knoot*, *Yonezawa*,

Shoham, *Egermeier* to modify the teaching of *Klippert II* in a manner that would yield a method that includes applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, and applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claims 1 and 18, and all claims depending therefrom, are patentable over the combination of *Klippert II, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

Additionally, claims 3-4, 6-9, 11-13, 15, 17, 20, 23-26, 28-30 and 32 are patentable over combination of *Klippert II, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier,* at least by their dependency from claims 1 and 18.

Accordingly, the Appellants request the reversal of the rejection to claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 and the allowance of the same.

C. 35 U.S.C. §103 Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32

Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Morioka* (U.S. Patent Publication No. 20040060659) in view of *Payne*, *Knoot* and *Yonezawa* or *Shoham* or *Egermeier*. The Appellants respectfully disagree.

Independent claims 1 and 18 recite elements not taught or suggested by the combination of *Morioka, Payne, Knoot,* and *Yonezawa, Shoham*, or *Egermeier. Morioka* teaches a measurement tool used to measure a pattern width, after completion of the etching operation. See paragraph 28, lines 9-10 of *Morioka*. *Morioka* teaches a post measurement process. *Morioka* does not teach or suggest using an outlier filter to filter a pre-etch critical dimension measurement data, utilizing the pre-etch critical dimension measurements to in-situ monitor an etch process, or using the pre- etch critical dimension measurement in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate. Furthermore, *Morioka* does not teach or suggest analyzing a pre-etch measurement information to determine process parameters to an etch process.

As discussed above, the teachings of *Payne,* and *Knoot* are not in the field of Appellants endeavor and not utilized to solve the same problem as discussed in the present application, nor does the record support utilization of the teachings of *Payne* and *Knoot* to obtain predictable results in the claimed subject matter. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for post-etching measurement. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. Thus, there is no suggestion from the teachings of *Payne, Tanaka, Knoot*, *Yonezawa*, *Shoham*, *Egermeier* to modify the teaching of *Morioka* in a manner that would not yield a method that includes applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, and applying an outlier filter to remove outliers in a pre-etch

critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claims 1 and 18, and all claims depending therefrom, are patentable over the combination of *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

Additionally, claims 3-4, 6-9, 11-13, 15, 17, 20, 23-26, 28-30 and 32 are patentable over combination of *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier,* at least by their dependency from claims 1 and 18.

Accordingly, the Appellants request the reversal of the rejection to claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 and the allowance of the same.

D. 35 U.S.C. §103 Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32

Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Petrucci* (WO 01/24254) in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier*. The Appellants disagree.

Independent claims 1 and 18 recite elements not taught or suggested by the combination of *Petrucci, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier. Petrucci* teaches using an endpoint algorithm to detect an endpoint of an etching process. However, *Petrucci* does not teach or suggest using an outlier filter to filter a pre-etch critical dimension measurement data, utilizing the pre-etch critical dimension measurement to in-situ monitor an etch process, or using the pre-etch critical dimension measurement in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate.

As discussed above, the teachings of *Payne* and *Knoot* are not in the field of Appellants endeavor and not utilized to solve the same problem as discussed in the present application, nor does the record support utilization of the teachings of *Payne* and *Knoot* to obtain predictable results. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for post-etching measurement. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. Thus, there is no suggestion from the teachings of *Payne, Tanaka, Knoot*, *Yonezawa*, *Shoham*, *Egermeier* to modify the teachings of *Petrucci* in a manner that would yield a method of applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, and applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claims 1 and 18, and all claims depending therefrom, are patentable over the combination of *Petrucci, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier.* Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

Additionally, claims 3-4, 6-9, 11-13, 15, 17, 20, 23-26, 28-30 and 32 are patentable over combination of *Petrucci, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier,* at least by their dependency from claims 1 and 18.

Accordingly, the Appellants request the reversal of the rejection to claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 and the allowance of the same.

E. 35 U.S.C. §103 Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32

Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* (U.S. Patent No. 6,390,019) in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier.* The Appellants disagree.

Independent claims 1 and 18 recite elements not taught or suggested by the combination of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier. Grimbergen* teaches using a process monitoring system mounted on top of a processing chamber to monitor a process. However, *Grimbergen* does not teach or suggest using an outlier filter to filter a pre-measurement data, utilizing the pre-etch critical dimension measurement to in-situ monitor an etch process, or using the pre-etch critical dimension measurements in combination with an etch process monitoring to determine critical dimension of structures formed in a substrate.

As discussed above, the teachings of *Payne* and *Knoot* are not in the field of Appellants endeavor and not utilized to solve the same problem as discussed in the present application, nor does the record support utilization of the teachings of *Payne* and *Knoot* to obtain predictable results. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for post-etching measurement. *Yonezawa* teaches an apparatus suitable for obtaining post-etching measurements. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. Thus, there is no suggestion from the teachings of *Payne, Tanaka, Knoot*, *Yonezawa*, *Shoham*, *Egermeier* to modify the

teachings of *Grimbergen* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, and applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claims 1 and 18, and all claims depending therefrom, are patentable over the combination of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

Additionally, claims 3-4, 6-9, 11-13, 15, 17, 20, 23-26, 28-30 and 32 are patentable over combination of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier,* at least by their dependency from claims 1 and 18.

Accordingly, the Appellants request the reversal of the rejection to claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 and the allowance of the same.

F. 35 U.S.C. §103 Claims 10, 20 and 27

Claims 10, 20 and 27 stand rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24, and further in view of *Bin Yu* (U.S. Patent No. 6,390,019). The Appellants respectfully disagree.

Independent claims 1 and 18, from which claims 10, 20 and 27 depend, recite elements not taught or suggested by the combination of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Bin Yu.* The patentability of claims 1 and 18 over *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* has been discussed above. *Bin Yu* is cited for its teaching of using a mask for etching that two sides and top of a feature is trimmed by substantially the same trim length. However, there is no teaching or suggestion from *Bin Yu* that would suggest to one of ordinary skill in the art to modify the teaching of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, or applying an outlier filter to remove outliers in pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18.

Thus, the Appellants submit that claims 10, 20 and 27, which depend from independent claims 1 and 18, are patentable over the combination of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Bin Yu.* Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

G. 35 U.S.C. §103 Claims 10, 20 and 27

Claims 10, 20 and 27 stand rejected under 35 U.S.C. §103 as being unpatentable over *Morioka* in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24, and further in view of *Bin Yu*. The Appellants respectfully disagree.

Independent claims 1 and 18, from which claims 10, 20 and 27 depend, recite elements not taught or suggested by the combination of *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Bin Yu.* The patentability of claims 1 and 18 over *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* has been discussed above. *Bin Yu* is cited for its teaching of using a mask for etching that two sides and top of a feature is trimmed by substantially the same trim length. However, there is no teaching or suggestion from *Bin Yu* that would suggest to one of ordinary skill in the art to modify the teaching of *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, or applying an outlier filter to remove outliers in pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18.

Thus, the Appellants submit that claims 10, 20 and 27, which depend from independent claims 1 and 18, are patentable over the combination of *Morioka, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Bin Yu.*

Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

H. 35 U.S.C. §103 Claims 16 and 33

Claims 16 and 33 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-9, 11-13, 15, 17-20, 23-26, 28-30 and 32, and further in view of *Grimbergen '924* (U.S. Patent No. 6,406,924). The Appellants respectfully disagree.

Independent claims 1 and 18, from which claims 16 and 33 depend, recite elements not taught or suggested by the combination of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Grimbergen '924.* The patentability of claims 1 and 18 over *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* has been discussed above. *Grimbergen '924* is cited for its teaching of detecting an interferometric signal shift in an endpoint detection system to monitor an etched structure formed in the substrate during an etching process. However, there is no teaching or suggestion from *Grimbergen '924* that would suggest to one of ordinary skill in the art to modify the teaching of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process and using the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the etch process endpoint, wherein the etch process monitoring comprises collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate, as recited by claim 1, or applying an outlier filter to remove outliers in pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in

combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18.

Thus, the Appellants submit that claims 16 and 33, which depend from independent claims 1 and 18, are patentable over the combination of *Grimbergen, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* and further in view of *Grimbergen '924*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

I. 35 U.S.C. §103 Claim 21

Claim 21 stands rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* in view of *Payne*, *Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and further in view of *Cha* (U.S. Patent No. 6,319,767). The Appellants respectfully disagree.

Independent claim 18, from which claim 21 depends, recites elements not taught or suggested by the combination of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* further in view of *Cha.* The patentability of claim 18 over *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* has been discussed above. *Cha* is cited for its teaching of reducing a photoresist mask by ashing. However, there is no teaching or suggestion from *Cha* that would suggest to one of ordinary skill in the art to modify the teaching of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa, Shoham*, or *Egermeier* in a manner that would yield applying an outlier filter to remove outliers in a pre-etch critical dimension measurement information, analyzing the pre-etch critical dimension measurement information to determine process parameters to an etch process, trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, as recited by claim 18. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that claim 21, which depends from claim 18, is patentable over the combination of *Toprac, Payne, Tanaka, Knoot,* and *Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claim allowed.

J. 35 U.S.C. §103 Claims 50-59

Claims 50-59 stand rejected under 35 U.S.C. §103 as being unpatentable over *Grimbergen* in view of *Payne*, *Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu*. In response, the Appellants have amended claim 50 to more clearly recite certain aspects of the invention.

Independent claim 50 recites elements not taught or suggested by the combination of *Grimbergen, Payne, Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu.* As discussed above, *Grimbergen* teaches using a process monitoring system mounted on top of a processing chamber to monitor a process. The teachings of *Payne* and *Knoot* are not in the field of Appellants endeavor. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for obtaining post-etching measurements. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. *Cha* is cited for reducing a photoresist mask by ashing. *Bin Yu* is cited for its teaching of using a mask for etching that two sides and top of a feature is trimmed by substantially the same trim length. Neither *Grimbergen, Payne, Knoot, Cha* nor *Bin Yu*, alone or in combination, teaches or suggests determining process parameters of an etch process, and trimming a mask using the etch process, wherein a filtered pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor trim process, as recited by claim 50. Nor does *Grimbergen, Payne, Knoot, Yonezawa*, *Shoham*, *Egermeier, Cha* nor *Bin Yu*, alone or in combination, teaches or provides a suggestion to modify their teachings in a manner that would yield determining process parameters of an etch process, and

trimming a mask using the etch process, wherein a filtered pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor trim process, as recited by claim 50. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claim 50, and claims 51-59 depending therefrom, are patentable over the combination of *Grimbergen* in view of *Payne*, *Tanaka, Knoot, Yonezawa*, *Shoham*, *Egermeier* and further in view of *Cha* and *Bin Yu*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

K. 35 U.S.C. §103 Claims 50-59

Claims 50-59 stand rejected under 35 U.S.C. §103 as being unpatentable over *Toprac* or *Klippert II* or *Petrucci* in view of *Payne*, *Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu*. The Appellants disagree.

Independent claim 50 recites elements not taught or suggested by the combination of *Toprac* or *Klippert II* or *Petrucci* in view of *Payne*, *Tanaka, Knoot, Yonezawa* or *Shoham* or *Egermeier* and further in view of *Cha* and *Bin Yu.* As discussed above, *Toprac* teaches measuring a thickness of a process layer disposed on a substrate before an etching process. *Klippert II* teaches measuring or estimating an etching rate of an etch process to better control the depth formed or etched in a layer disposed on a substrate during an etching process. *Petrucci* teaches using an endpoint algorithm to detect an endpoint of an etching process. The teachings of *Payne* and *Knoot* are not in the field of Appellants endeavor. *Tanaka* does not teach or suggest analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process, and the pre-etch measurements are critical dimension measurements. *Yonezawa* teaches an apparatus suitable for obtaining post-etching measurements. *Shoham* teaches using an endpoint detector used in a CMP system. *Egermeier* teaches using a detector to detect contaminant range on a substrate. *Cha* is cited for ashing a photoresist mask. *Bin Yu* is cited for its teaching of using a mask for

etching that two sides and top of a feature is trimmed by substantially the same trim length.

Neither *Toprac*, *Klippert II, Petrucci, Payne*, *Tanaka, Knoot, Yonezawa*, *Shoham, Egermeier, Cha, Bin Yu*, alone or in combination, teaches or suggests determining process parameters of an etch process, and trimming a mask using the etch process, wherein a filtered pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor trim process, as recited by claim 50. Nor does *Toprac*, *Klippert II, Petrucci, Payne*, *Tanaka, Knoot, Yonezawa*, *Shoham, Egermeier, Cha,* nor *Bin Yu*, alone or in combination, teach or suggest determining process parameters of an etch process, and trimming a mask using the etch process, wherein a filtered pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor trim process, as recited by claim 50. As such, a *prima facie* case of obviousness has not been established as the references fail to teach each claimed element.

Thus, the Appellants submit that independent claim 50, and claims 51-59 depending therefrom, are patentable over the combination of *Toprac* or *Klippert II* or *Petrucci* in view of *Payne*, *Tanaka, Knoot, Yonezawa*, *Shoham, Egermeier* and further in view of *Cha* and *Bin Yu*. Accordingly, the Appellants respectfully request that the rejection be withdrawn and the claims allowed.

CONCLUSION

For the reasons advanced above, the Appellants respectfully urge that the rejections of claims 1, 3-4, 6-13, 15-18, 20-21, 23-30, 32-33, and 50-59 as being unpatentable under 35 U.S.C. §103 are improper. Reversal of the rejections in this appeal is requested.

Respectfully submitted,

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Date

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CLAIMS APPENDIX

1. (Previously Presented) A method for monitoring an etch process, comprising:

(a) performing pre-etch critical dimension (CD) measurements of a substrate to generate pre-etch measurement information;

(b) applying an outlier filter to remove outliers in the pre-etch measurement information;

(c) analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process;

(d) providing the substrate along with the pre-etch measurement information to an etch reactor;

(e) etching the substrate in the etch reactor to form structures in the substrate using the etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor an etch process endpoint, wherein the etch process monitoring comprises:

directing radiation onto the substrate, wherein an intensity of the radiation is modulated at a frequency of about 10 Hz; and

collecting a portion of the radiation reflected from the substrate to determine critical dimension of the structures formed in the substrate; and

(f) terminating the etch process based on the etch process monitoring having identified that the etch process has reached the etch process endpoint.

2. (Cancelled)

3. (Previously Presented) The method of claim 1 wherein the etch process monitoring of step (f) further comprises achieving a pre-determined etch depth for the etch process.

4. (Previously Presented) The method of claim 1 wherein the etch process monitoring of step (f) further comprises achieving pre-determined feature dimensions for structures formed during the etch process.

5. (Cancelled)

6. (Previously Presented) The method of claim 1 wherein the pre-etch measurement information is obtained using optical metrology.

7. (Previously Presented) The method of claim 6 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.

8. (Original) The method of claim 1 wherein the etch process monitoring is performed using optical metrology.

9. (Original) The method of claim 8 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.

10. (Original) The method of claim 1 wherein the etch process monitoring further comprises:

using a correlation between a vertical etch rate and a horizontal etch rate.

11. (Previously Presented) The method of claim 1 wherein the etch process monitoring further comprises:

using an interferometric measuring technique to measure a thickness of a layer.

12. (Original) The method of claim 11 wherein the radiation is directed substantially perpendicular to the substrate.

13. (Original) The method of claim 11 wherein the spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.

14. (Cancelled)

15. (Previously Presented) The method of claim 1 wherein the etch process monitoring further comprises:

measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate.

16. (Original) The method of claim 15 wherein the etch process monitoring further comprises:

using a correlation between a spectral position of a minimum in the spectrum and a width of structures formed on the substrate.

17. (Original) The method of claim 1 wherein the pre-etch measurements are provided by one of a metrology module coupled to a process system including the etch reactor and a metrology module removed from said process system.

18. (Previously Presented) A method for monitoring an endpoint of a mask trimming process, comprising:

(a) performing pre-etch critical dimension measurements of a substrate having a mask thereon to generate pre-etch critical dimension measurement information of such mask;

(b) applying an outlier filter to remove outliers in the pre-etch critical dimension measurement information;

(c) analyzing the pre-etch critical dimension measurement information to determine that the mask is of a sufficient quality to allow for etching of the substrate and to determine process parameters to an etch process;

(d) providing the substrate along with the pre-etch critical dimension measurement information to an etch reactor;

(e) trimming the mask using the etch process, wherein the pre-etch critical dimension measurement information in combination with etch process monitoring are used to in-situ monitor the trimming the mask, wherein the etch process monitoring comprises:

directing radiation onto the substrate, wherein an intensity of the radiation is modulated at a frequency of about 10 Hz; and

collecting a portion of the radiation reflected from the substrate; and

(f) terminating the trim process when the etch process monitoring indicates that the mask has been trimmed to pre-determined dimensions.

19. (Cancelled)

20. (Original) The method of claim 18 wherein the mask is a photoresist patterned mask.

21. (Original) The method of claim 18 wherein the mask is trimmed using a plasma process.

22. (Cancelled)

23. (Previously Presented) The method of claim 18 wherein the pre-etch measurement information is obtained using optical metrology.

24. (Original) The method of claim 23 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.

25. (Original) The method of claim 18 wherein the etch process monitoring is performed using optical metrology.

26. (Original) The method of claim 25 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.

27. (Original) The method of claim 18 wherein the etch process monitoring further comprises:

using a correlation between a vertical etch rate and a horizontal etch rate.

28. (Previously Presented) The method of claim 18 wherein the etch process monitoring further comprises:

using an interferometric measuring technique to measure a thickness of a layer.

29. (Original) The method of claim 28 wherein the radiation is directed substantially perpendicular to the substrate.

30. (Original) The method of claim 28 wherein a spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.

31. (Cancelled)

32. (Previously Presented) The method of claim 18 wherein the etch process monitoring further comprises:

measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate.

33. (Original) The method of claim 32 wherein the etch process monitoring further comprises:

using a correlation between a spectral position of a minimum in the spectrum and a width of the structures formed on the substrate.

34-49. (Cancelled)

50. (Previously Presented) A method for monitoring an endpoint of a mask trimming process, comprising:

(a) performing pre-etch measurements of a substrate having a patterned mask thereon to generate pre-etch measurement information of such mask, wherein the pre-etch measurements include width of structures comprising the patterned mask;

(b) applying an outlier filter to remove width outliers in the pre-etch measurement information;

(c) providing the substrate along with the filtered pre-etch measurement information to an etch reactor;

(d) determining process parameters of an etch process in response to the pre-etch measurement information;

(e) trimming the mask using the etch process, wherein the filtered pre-etch measurement information in combination with etch process monitoring are used to in-situ monitor trim process, wherein the etch process monitoring comprises directing radiation having an intensity modulated at a frequency of about 10 Hz onto the substrate, collecting a portion of the radiation reflected from the substrate, measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate, and using a correlation between a spectral position of a minimum in the spectrum and a width of the structures formed on the substrate; and

(f) terminating the trim process when the etch process monitoring indicates that the mask has been trimmed to pre-determined dimensions.

51. (Previously Presented) The method of claim 50 wherein the mask is a photoresist patterned mask.

52. (Previously Presented) The method of claim 50 wherein the mask is trimmed using a plasma process.

53. (Previously Presented) The method of claim 50 wherein the pre-etch measurement information is obtained using optical metrology.

54. (Previously Presented) The method of claim 53 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.

55. (Previously Presented) The method of claim 50 wherein the etch process monitoring is performed using optical metrology.

56. (Previously Presented) The method of claim 56 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.

57. (Previously Presented) The method of claim 50 wherein the etch process monitoring further comprises:

using a correlation between a vertical etch rate and a horizontal etch rate.

58. (Previously Presented) The method of claim 50 wherein the radiation is directed substantially perpendicular to the substrate.

59. (Previously Presented) The method of claim 50 wherein a spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.

60. (Cancelled)

EVIDENCE APPENDIX

The Appellants state that there is no evidence submitted under 37 C.F.R. §1.130, 1.131 or 1.132, or other evidence entered by the Examiner or relied upon by the Appellants in the Appeal.

RELATED PROCEEDINGS APPENDIX

No copies of decisions rendered by a court or the Board in the related appeal or interference listed on page 4 of this Brief are included as there have been no decisions by the court or the Board in the related appeal or interference listed on page 4 of this Brief.